

Roanoke Civic Center Coliseum Roof Rigging Guide

Roanoke, Virginia

24 February 2012

**ROANOKE CIVIC CENTER
COLISEUM ROOF RIGGING GUIDE
Roanoke, Virginia**

February 24, 2012

1. Introduction

The City of Roanoke retained AECOM to evaluate the roof system of the Roanoke Civic Center Coliseum in order to determine its structural capacity and develop a rigging guide that communicates allowable hanging loads on the roof trusses. The Coliseum hosts a variety of events which require loads of various magnitudes and configurations to be suspended from the roof trusses. The rigging guide will serve to provide rigging contractors for each event with clearly-defined limitations on the placement and magnitude of these loads.

2. Building Description

The Roanoke Civic Center Coliseum was constructed in 1971. The roof construction consists of membrane roofing on 3-inch composition deck which is supported by steel beams and trusses. The trusses span 168 feet across the building and bear on cast-in-place concrete frames. A schematic diagram of a typical truss is used on the following pages to communicate allowable loads that may be applied. Information related to the trusses, such as the configuration, size and shape of steel members and the material properties of the steel, is derived from a set of as-built construction drawings dated December 30, 1967 that was provided to AECOM by Roanoke City.

3. Observed Conditions

AECOM performed a field survey of the Coliseum roof structure, observing those structural elements that could be accessed from a lift positioned on the floor or from the catwalks at roof level. Several typical truss connections were measured in order to calculate connection capacity. The field survey did not reveal any signs of structural distress or deterioration or any discrepancies between the as-built drawings and actual field conditions.

4. Rigging Guide Summary

At an initial teleconference with Roanoke City and Roanoke Civic Center personnel, it was determined that AECOM would evaluate the three most common rigging scenarios experienced in the Roanoke Civic Center Coliseum. The following three rigging scenarios, called load cases, were evaluated and are reflected in the Rigging Guide Diagrams. The structural analysis was based on loads being applied at the bottom-chord panel points of these trusses only (as shown on the Rigging Guide Diagram Sheets 2, 4 and 6).

- Load Case 1: Single load at midspan.
- Load Case 2: Two loads, located near the edges of the Coliseum floor.
- Load Case 3: Loads at each panel point.

The trusses at each end of the building (along Column Lines F and U) carry existing loads that are significantly different from the other trusses. Therefore, different allowable rigging loads apply to these trusses, and this difference is communicated in the Rigging Guide Diagrams.



In order to provide more flexibility for location of rigging points, the existing beams at the bottom-chord level were evaluated and found to be sufficient for rigging loads of limited magnitude. The option to use these beams is explained in the Rigging Guide Diagrams. Sheets 1, 3 and 5 of the Diagrams show the location of the beams.

5. Structural Analysis

AECOM performed a structural analysis of the roof trusses in order to determine excess capacity for hanging loads. The geometry and truss member sizes were based on the as-built drawings, which were also used to help determine existing loads that are carried by the trusses. Information on the weights of the scoreboard, mechanical equipment, and stage curtain was provided by Roanoke City. The as-built drawings include design loads at top- and bottom-chord panel points as well as member forces for the individual truss members. The loads from the as-built drawings were used as an initial loading scenario in order to calibrate the analysis model, and consistent agreement was found between the member force output from the analysis, and the member forces shown on the as-built drawings.

Several of the truss connection capacities were checked based on measurements taken in the field and the member forces from the as-built drawings. All of the connections evaluated had sufficient capacity to support the forces shown on the drawings.

It is noted that the existing roof loads to the top-chord panel points are approximately 25% lighter than those indicated on the as-built drawings. This is because the original roofing system had gravel ballast, making it significantly heavier than the current membrane roofing. The weight of the current roofing system was used in the analysis. Therefore, if a heavier roofing material is used in the future, the allowable rigging loads will need to be adjusted.

The full 50-year snow load was calculated in accordance with the 2009 Virginia Uniform Statewide Building Code (2009 VUSBC) and applied to the entire roof surface. In order to capture the possible use of catwalks during Civic Center events, an occupancy live load of 25 pounds per square foot was assumed for the catwalk areas supported by the trusses. In addition to the full snow load scenario, a load combination of 75 percent of snow load plus 75 percent of catwalk live load was included in the analysis, in accordance with the 2009 VUSBC.

Once the existing truss loads were incorporated in the truss analysis model, allowable rigging loads were determined based on the following criteria:

- Do not exceed existing member strengths calculated using American Institute of Steel Construction (AISC) specifications.
- Do not exceed the member forces shown on the as-built drawings for any truss member.
- Do not exceed the truss end reactions calculated using the truss design loads shown on the as-built drawings.

In addition to the steel truss analysis, the capacity of the supporting concrete frames was verified. The cantilevered portion of the concrete frames was checked for the maximum truss reaction, along with the other loads that it carries, and found to have sufficient capacity.

Report prepared by:

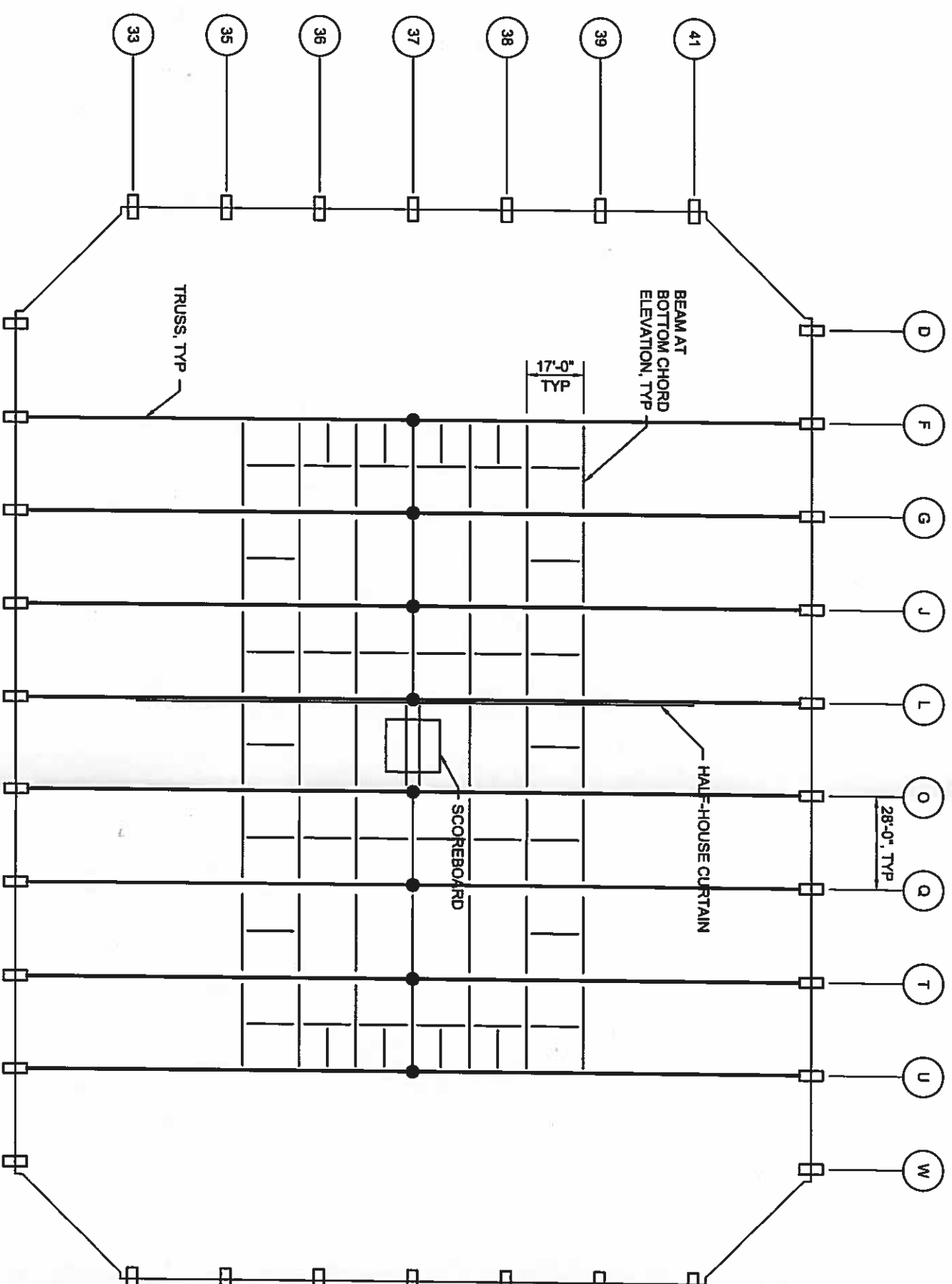
AECOM

Bradley D. Townsend

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Project	ROANOKE CIVIC CENTER RIGGING ANALYSIS		Project No.	60242930	
Title	RIGGING GUIDE DIAGRAMS		Phase		
			Date	2/24/2012	
Des By	BDT	Dept	STRUCTURAL		Rev Date
Ckd By	DML	Sketch	SK-		Sheet No.
				1	Of 6



RIGGING LOADS (SEE SH 2 OF 6)

● 8,000 LBS

COLISEUM PLAN - LOAD CASE 1

NO SCALE

Ref Drawing:

Project No. 60242930

Phase

Date 2/24/2012Des By BDT Dept STRUCTURAL Rev Date _____

Rev Date

Ckd By DML Sketch SK- Sheet No. 2 Of 6

Sheet No.

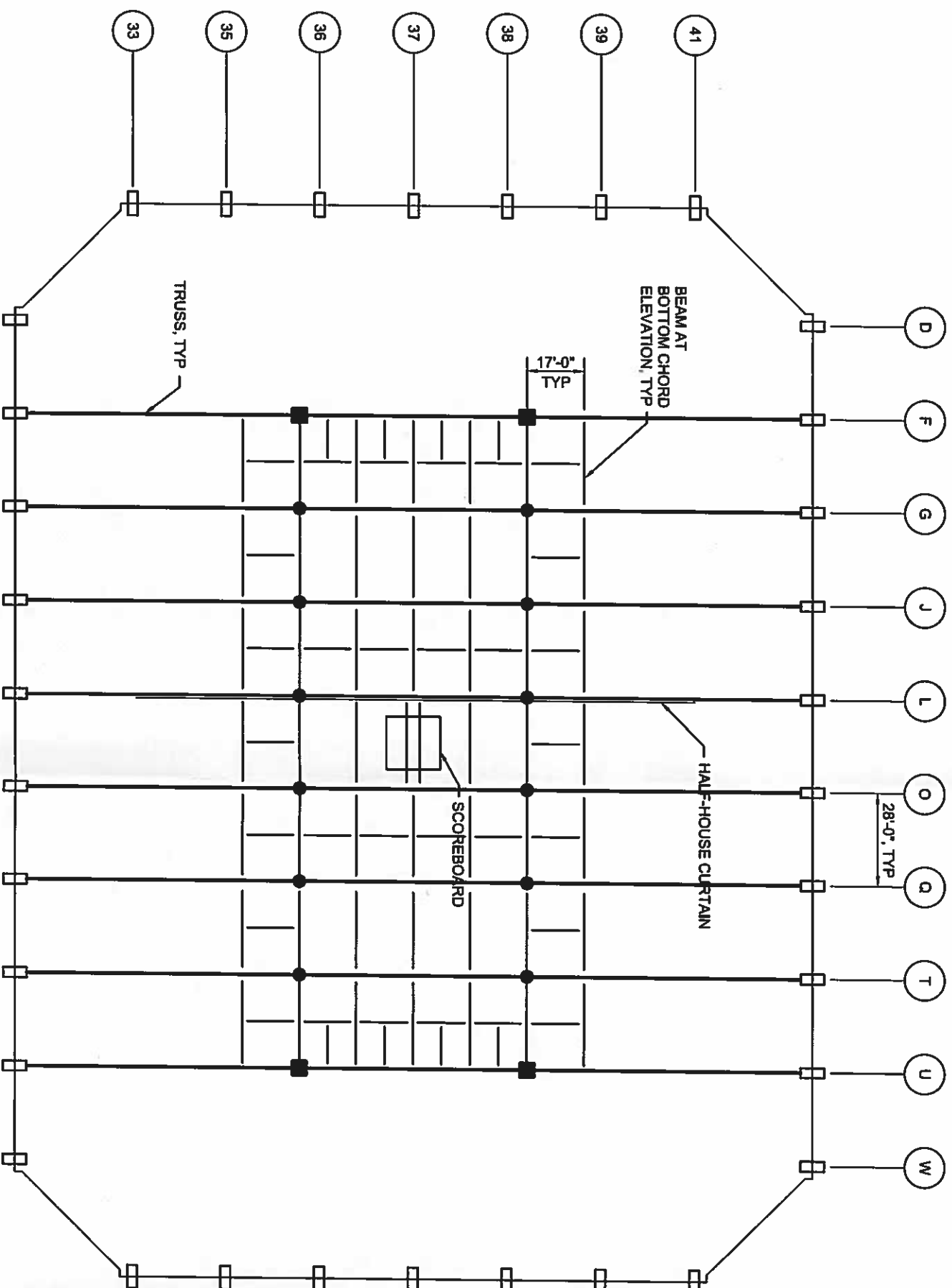


NOTES:

1. THE LOADS SHOWN ARE THE MAXIMUM SERVICE RIGGING REACTIONS WHICH MAY BE APPLIED TO ANY ROOF TRUSS.
2. ANY SIGNIFICANT INCREASE IN WEIGHT OF ROOF CONSTRUCTION OR PERMANENT EQUIPMENT SUPPORTED BY THE TRUSSES WILL RESULT IN A DECREASE IN THE LOADS SHOWN.
3. LOAD MUST BE APPLIED AT TRUSS PANEL POINT AS SHOWN.
4. EXISTING BEAMS AT THE BOTTOM-CHORD LEVEL MAY BE USED TO DELIVER RIGGING LOADS TO THE TRUSSES. HOWEVER, THE LOAD APPLIED TO THESE BEAMS SHALL BE LIMITED TO 3,000 LBS CARRIED BY ANY GIVEN BEAM.
5. THE SINGLE LOAD SHOWN HERE MAY BE APPLIED TO ANY TRUSS PANEL POINT.

Ref Drawing:

Project	ROANOKE CIVIC CENTER RIGGING ANALYSIS		Project No.	60242930	
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RIGGING LOADS (SEE SH 4 OF 6)

- 15,000 LBS
■ 9,000 LBS

COLISEUM PLAN - LOAD CASE 2

Ref Drawing:

Project No. 60242930

Phase

Date 2/24/2012Des By BDT Dept STRUCTURAL

Rev Date

Ckd By DML Sketch SK- Sheet No. 4 Of 6

Sheet No.



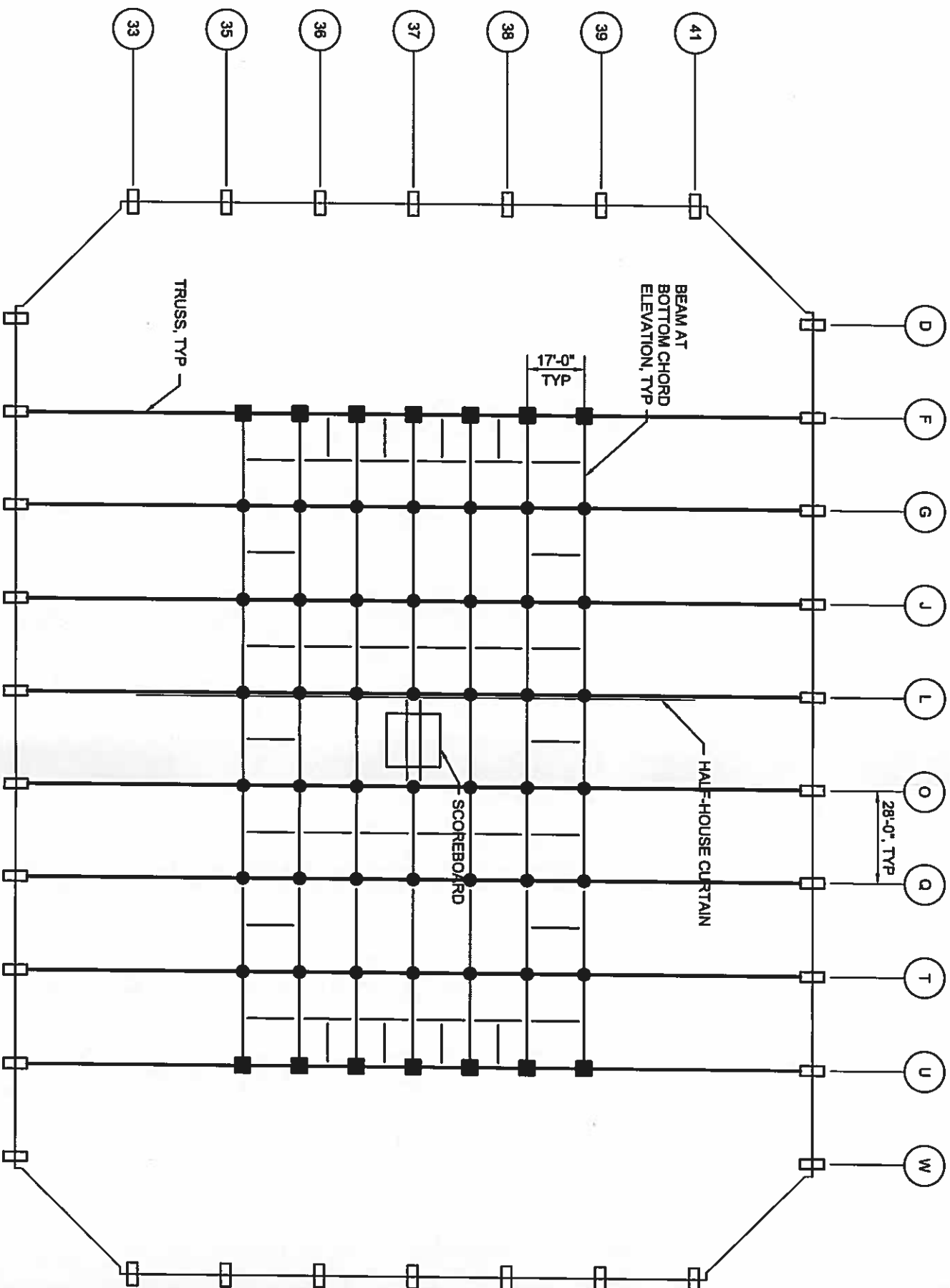
NOTES:

1. THE LOADS SHOWN ARE THE MAXIMUM SERVICE RIGGING REACTIONS WHICH MAY BE APPLIED TO THE TRUSSES ALONG GRIDS F AND U (SEE PLAN). THE LOADS MAY BE INCREASED TO 15,000 POUNDS FOR ALL OTHER TRUSSES.
2. ANY SIGNIFICANT INCREASE IN WEIGHT OF ROOF CONSTRUCTION OR PERMANENT EQUIPMENT SUPPORTED BY THE TRUSSES WILL RESULT IN A DECREASE IN THE LOADS SHOWN.
3. ALL LOADS MUST BE APPLIED AT TRUSS PANEL POINTS AS SHOWN.
4. EXISTING BEAMS AT THE BOTTOM-CHORD LEVEL MAY BE USED TO DELIVER RIGGING LOADS TO THE TRUSSES. HOWEVER, THE LOAD APPLIED TO THESE BEAMS SHALL BE LIMITED TO 3,000 LBS CARRIED BY ANY GIVEN BEAM.
5. THE LOADS SHOWN HERE MAY BE APPLIED AT THE LOCATIONS SHOWN, OR AT PANEL POINTS FARTHER FROM THE BUILDING CENTERLINE.

Ref Drawing:

REFLECTED ON THE STUDIES DESIGN, CALCULATION STRUCTURE, OR ANALYSIS METHOD — 02/24/2012 10:02A TOWNSEND, PAUL
IT! NONE AND NONE

Project	ROANOKE CIVIC CENTER RIGGING ANALYSIS		Project No.	60242930	
Title	RIGGING GUIDE DIAGRAMS		Phase		
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RIGGING LOADS (SEE SH 6 OF 6)

- 4,500 LBS
■ 2,000 LBS

COLISEUM PLAN - LOAD CASE 3

Ref Drawing:

RIGGING GUIDE DIAGRAMS

Phase

Project No. 60242930

Phase

Date 2/24/2012Des By BDT Dept STRUCTURAL

Rev Date

CKd By DML

SK-Sketch

Sheet No. 6 Of 6

NOTES:

1. THE LOADS SHOWN ARE THE MAXIMUM SERVICE RIGGING REACTIONS WHICH MAY BE APPLIED TO THE TRUSSES ALONG GRIDS F AND U (SEE PLAN). THE LOADS MAY BE INCREASED TO 4,500 POUNDS FOR ALL OTHER TRUSSES.
2. ANY SIGNIFICANT INCREASE IN WEIGHT OF ROOF CONSTRUCTION OR PERMANENT EQUIPMENT SUPPORTED BY THE TRUSSES WILL RESULT IN A DECREASE IN THE LOADS SHOWN.
3. ALL LOADS MUST BE APPLIED AT TRUSS PANEL POINTS AS SHOWN.
4. EXISTING BEAMS AT THE BOTTOM-CHORD LEVEL MAY BE USED TO DELIVER RIGGING LOADS TO THE TRUSSES. HOWEVER, THE LOAD APPLIED TO THESE BEAMS SHALL BE LIMITED TO 3,000 LBS CARRIED BY ANY GIVEN BEAM.

Ref Drawing: